ORIGINAL ARTICLE

Outcomes Following Surgery for Distal Rectal Cancers: A Comparison between Laparoscopic and Open Abdomino-Perineal Resection

K K Tan, FRCS (Edin), C S Chong, MRCS (Edin), C B Tsang, FRCS (Edin), D C Koh, FRCS (Edin)

Division of Colorectal Surgery, Department of Surgery, National University Health System, Singapore

SUMMARY

Purpose: Oncologic outcomes following laparoscopic abdomino-perineal resection (APR) for distal rectal cancer are infrequently reported. This study aims to compare the long term outcomes between laparoscopic and open APR in distal rectal cancers.

Methods: A retrospective review of all patients who underwent APR for distal rectal cancer from May 2001 to November 2009 was performed.

Results: Forty-two patients, median age 60 (24 – 86) years, formed the study group. Laparoscopic resection was attempted in 16 patients and was successful in all but one. Patients with recurrent diseases, previous abdominal operations and neoadjuvant chemoradiation were more likely to undergo open APR. There were no differences in the T-staging, number of lymph nodes harvested or the final stage of the disease between the two groups. The laparoscopic APR group had a shorter median length of hospitalization (7 vs. 10 days, p < 0.05), but longer operative duration (300 vs. 240 minutes, p > 0.05).

Excluding the 9 (21.4%) patients with metastatic disease on presentation, 13 (39.4%) developed recurrence after a median follow up of 24 (4 – 107) months. Twenty (47.6%) patients died from their advanced disease subsequently while one (2.4%) died from a noncancer related cause. Analysis showed that tumour stage and circumferential resection margin positivity were associated with a poorer survival. The types of approach had no significant impact on the survival.

Conclusion: Laparoscopic APR for distal rectal cancer yields similar oncologic outcomes as open APR. Long-term outcome is determined by the tumour stage and circumferential resection margin and not the approach.

INTRODUCTION

Laparoscopic colectomy has been shown to be comparable with open colectomy in the management of colon cancer [1-2]. On the other hand, despite proven advantages, laparoscopic proctectomy including abdomino-perineal resection (APR) for the treatment of rectal cancer remains controversial [3]. The main concerns with laparoscopic proctectomy are related to its technical difficulty in performing a complete total mesorectal excision (TME) especially in a deep pelvis (e.g. in heavy set males), the possible need to take down the splenic flexure, achieving a distal transection of the rectum in the deep pelvis, and then performing the anastomosis intra-corporeally [4-5].

The obvious advantage of the laparoscopic approach in performing an APR lies in the fact that there is no requirement in performing an intra-corporeal low rectal anastomosis. The specimen is retrieved through the perineal wound thereby eliminating the need to create an incision for extraction [4-5]. However, long term data comparing laparoscopic to open APR remains limited [6-7]. This study aims to compare the short and long term outcomes between the two approaches, specifically looking at long term outcomes and survival.

MATERIALS AND METHODS

A retrospective review of all patients who underwent APR for histologically confirmed distal rectal cancer from May 2001 to November 2009 was performed. All patients with rectal cancers were discussed at a multidisciplinary tumour group meeting to determine the need for pre- and post-operative adjuvant therapy.

The decision to perform an APR, either laparoscopic or open, for rectal adenocarcinoma was made based on whether it was possible to achieve an adequate distal resection margin with a sphincter salvage procedure. This was determined using rigid proctoscopy, endorectal ultrasonography (ERUS) or/and magnetic resonance imaging (MRI). The choice of adopting the open or laparoscopic approach was based on surgeon preference. The laparoscopic procedures were all performed by trained colorectal surgeons who had significant experience in laparoscopic colorectal surgery [8-9]. All cases were carried out in an elective setting.

Data collected included patient demographics, perioperative variables and cancer-specific outcomes. In addition, follow up and long term data were also collated. Conversion from laparoscopy was defined as an incision made on the abdomen longer or earlier than planned in order to perform any part of the operation. Follow up was performed as per recommendation from the international guidelines [10-11]. Disease recurrence was defined as the presence of disease either locally or distantly by radiological and/or pathological

This article was accepted: 30 December 2011
Corresponding Author: Ker-Kan Tan, Division of Colorectal Surgery, Department of Surgery, National University Health System, Singapore
Email: kerkan@gmail.com

evaluation. Cancer-related mortality was defined as death arising resulting from the primary cancer.

Statistical analysis was performed using the SPSS 17.0 statistical package (Chicago, Illinois, USA) and all p values reported are two-sided. All p values < 0.05 were considered statistically significant. Fisher's exact test and Mann-Whitney U test were used for analyses of categorical variables and continuous variables, respectively. The overall survival probability was estimated according to the Kaplan-Meier method of analysis.

RESULTS

During the study period, 42 patients underwent APR for distal rectal cancer. The median age of the study group was 60 (24 – 86) years, with a slight male predominance (54.8%, n = 23). Five (11.9%) patients underwent surgery for a local recurrence after a median of 18 (14 - 26) months following an initial curative anterior resection for rectal cancer of which two were performed laparoscopically. Three had stage III disease then while information on the other two foreign patients was unavailable as their primary surgery was performed in their home country. Another patient had metachronous recurrence in the rectum two years after a colonic resection.

Fourteen (33.3%) patients received neoadjuvant chemoradiation prior to surgical treatment. Laparoscopic resection was attempted in 16 patients and successfully completed in 15 of them (93.8%). Eleven were performed using the hand-assisted laparoscopic technique as described by the senior author [12]. Three underwent standard laparoscopic APR without the assistance of the hand device, while the last patient underwent robotically assisted laparoscopic APR. The one conversion was due to extensive adhesions from a previous laparotomy performed for a gynaecological condition.

The patient and disease data comparing the two groups are shown in Table I. Patients with recurrent disease, previous abdominal operations and neoadjuvant chemoradiation were more likely to undergo open APR although the difference did not reach statistical significance. All patients who required enbloc multivisceral resection understandably had their procedures performed using the open technique. The laparoscopic group was associated with a slightly longer operative time, but shorter length of stay, when compared to the open group.

There was no significant difference between the two groups in terms of the size of tumour, Tstage, and number of lymph node harvested. Nine (21.4%) patients had metastatic disease on presentation. A total of 16 (38.1%) patients from both groups (p > 0.05) subsequently received comparable adjuvant therapy. Adjuvant chemo-, radio-therapy or combination chemoradiation were administered to eleven, two and three patients, respectively.

The quality of total mesorectal excision in all the patients in our study was deemed to be complete. Fifteen (35.7%) patients in total from both groups had positive circumferential resection margins (CRM) (defined as involvement of or within 1mm from the mesorectal fascia) of which twelve belonged to the open group. In these 15 patients, 4 had T4 disease while the remaining had T3 disease. Three of them had multi-visceral resection as well. Factors such as multi-visceral resection, recurrent diseases, the presence of neoadjuvant chemoradiation and the type of surgeries were not associated with CRM involvement. However, a positive CRM was associated with advanced stage and specifically the T-stage of the primary tumour (p < 0.05).

Complications

There were no 30-day or in-hospital mortalities in our series. One patient from the open group experienced significant intraoperative pre-sacral venous plexus bleeding and haemodynamic instability. The pelvis was packed with surgical towels after achieving partial haemostasis with thumbtack application and surgical clips. The patient was brought to the intensive care unit for stabilization. Two further laparotomies were performed to achieve and ensure that haemostasis was secured. He was eventually discharged well 43 days after the first surgery.

Morbidity rates were 25.9 % for the open group versus 20.0 % for the laparoscopic group. Table II illustrates the various complications between the two groups. The peri-operative morbidities included ileus which was present in 5 patients; 4 from the open, and 1 from the laparoscopic group. Wound infection developed in patients only from the open group: 1 involving the midline incision while 2 other patients had perineal wound infections, for which 1 required surgical debridement. Urinary tract infection developed in 4 patients, equally distributed between the two groups.

Over the duration of their follow up, one patient from the laparoscopic group underwent surgical repair of his symptomatic parastomal hernia two years after the initial surgery. In the open group, 1 patient underwent a surgical repair of an incisional hernia, while another had revision of a prolapsed colostomy.

Follow up

The median follow up period for the study group was 24 (4 – 107) months. After excluding the nine (21.4%) patients with metastatic disease on presentation, 13 (39.4%) patients developed local and/or distant recurrence. The most common sites of recurrence were in the pelvis, lungs and the liver (Table III). The median time after surgery until the detection of disease recurrence was 13 (3 – 88) months. One patient with an isolated hepatic metastasis underwent segmentectomy five years from the initial APR. She remains well as of the most recent review with no evidence of disease. There were no port site recurrences detected in the laparoscopic group of patients. No statistical significant difference in the rate of disease recurrence was detected between the two groups.

In total, 21 patients (50.0%) eventually died; twenty were cancer-related: nine had metastatic disease on presentation while the rest died from their local and/or systemic

Table I: Characteristics of the study group

	Open APR (n = 27) (Including the converted case)	Laparoscopic APR (n = 15)	p value
Age > 60 years	16 (59.3%)	8 (53.3%)	> 0.05
Operation for locally recurrent disease after previous curative resection	4 (14.8%)	1 (6.7%)	> 0.05
Previous major abdominal surgery	7 (25.9%)	2 (13.3%)	> 0.05
Received neoadjuvant chemoradiation	11 (40.7%)	3 (20.0%)	> 0.05
Median size of tumour (Maximum diameter)	4 (0 – 16) cm	5 (2 – 8) cm	> 0.05
T4 tumours	3	0	> 0.05
Median number of lymph nodes harvested	12 (0 – 33)	12 (4 – 29)	> 0.05
Multi-visceral resection	6 (22.2%)	0	< 0.05
Positive circumferential resection margin (CRM)	12 (44.4%)	3 (20.0%)	> 0.05
Stage I or II disease	7 (25.9%)	6 (40.0%)	> 0.05
Stage IV disease	7 (25.9%)	2 (13.3%)	> 0.05
Median Operative time	4 (2 – 8) hours	5 (2 – 8.5) hours	> 0.05
Median length of stay	10 (6 – 41) days	7 (5 – 43) hours	< 0.05

Table II: Peri-operative complications

Complication	Open APR (n = 27)	Laparoscopic APR (n = 15)
Relook laparotomy	1 (3.7%)	0
Wound infection	2 (7.4%)	0
Ileus	4 (14.8%)	1 (6.7%)
Urinary tract infection	2 (7.4%)	2 (13.3%)
Total number of patients with complications	7 (25.9%)	3 (20.0%)

Table III: Details of disease recurrence

	Number of patients
Recurrent disease	13/33 (39.4%)
Median time to recurrence	13 13 (3 – 88) months
Site of recurrence	
- Liver	- 4
- Lung	- 6
- Adrenal	- 1
- Bone	- 1
- Brain	- 2
- Local recurrence	- 6

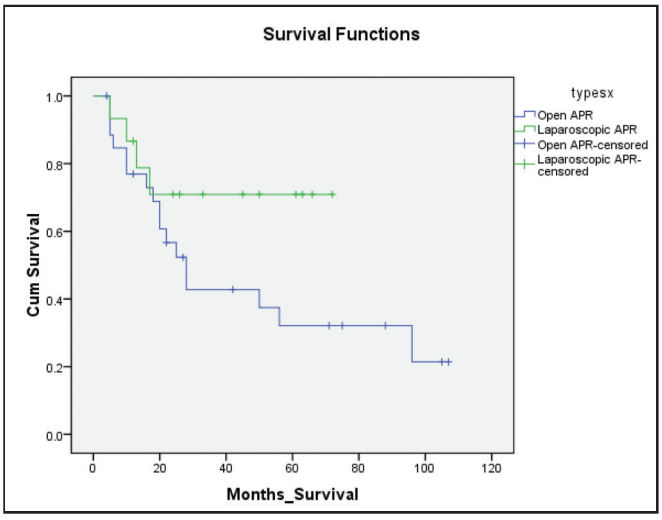

Fig. 1 : Overall survival curves with references to the technique of APR.

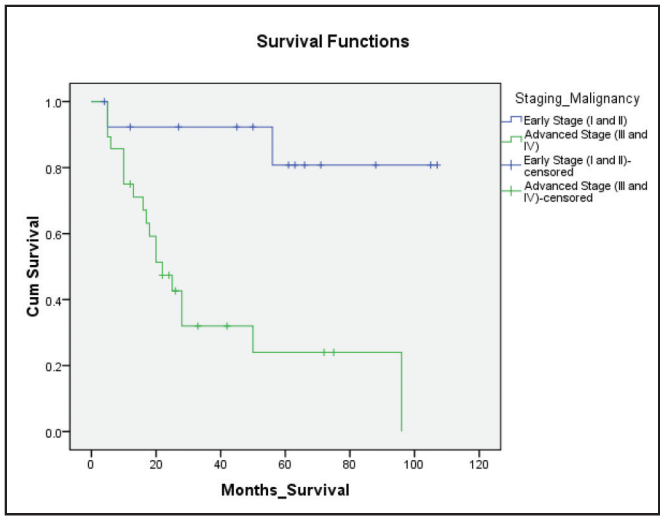

Fig. 2 : Overall survival curves with references to the stage of the malignancy.

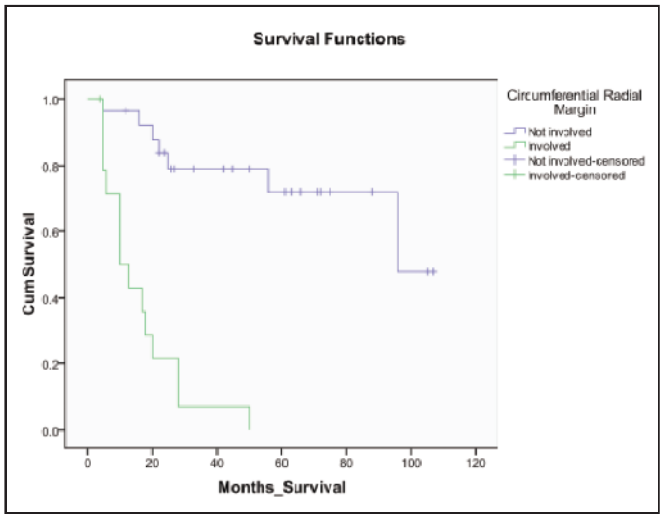

Fig. 3 : Overall survival curves with references to the circumferential radial margin.

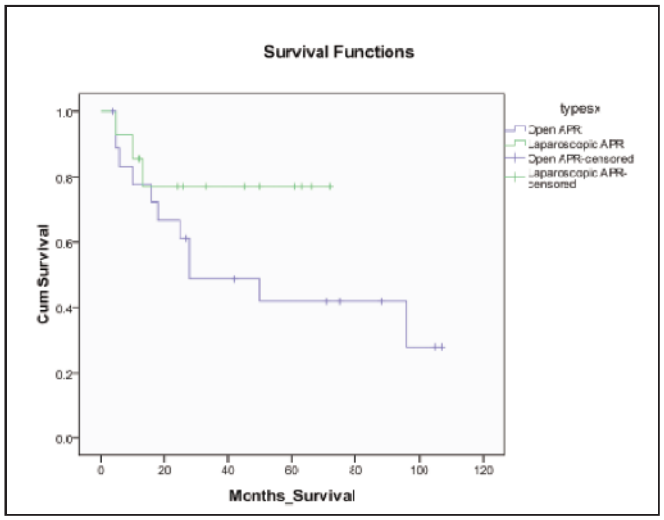

Fig. 4 : Overall survival curves comparing the two types of APR after excluding the complex cases.

recurrences. The majority (84.6%) from the latter group had stage III disease on presentation. The last patient died from a cardiac arrest, not related to the rectal cancer. There appears to be a slight survival advantage conferred in the laparoscopic over the open APR group (Figure 1). The two factors that were significantly associated with the poorer overall survival were advanced stage of malignancy ($p < 0.001$) (Figure 2) and positive circumferential resection margins ($p < 0.001$) (Figure 3). The overall mean survival time of patients with positive and negative circumferential resection margins were 16.1 (95% CI: 9.5 – 22.6) and 82.1 (95% CI: 66.8 – 97.4) months, respectively.

DISCUSSION

Laparoscopic APR is ideal in the surgical management of patients with distal rectal cancer. Some of the obvious advantages would include the avoidance of performing an intracorporeal anastomosis and the ability to deliver the specimen through the perineal incision [4-7]. Apart from the increased technical difficulties [6, 13], the oncologic outcomes of laparoscopic APR has not been proven in large trials. Although results from our series suggest that laparoscopic APR may confer a slight advantage in overall survival, this can be partly attributed to the patient selection in each group, with a higher proportion of patients undergoing resection for recurrent disease and those requiring enbloc multivisceral resection in the open APR group. A subsequent analysis of the two groups after excluding these technically more complex cases (n = 9) demonstrated a comparable survival curve (Figure 4). The overall mean survival for patients in the laparoscopic and open APR groups in this analysis were 54.9 (95% CI: 34.7 – 75.2) months and 57.7 (95% CI: 43.4 – 72.0) months, respectively ($p > 0.05$).

The operative time in the laparoscopic group was slightly longer when compared to the open group. This difference has often been reported in other series [1-2, 6]. The authors postulated that the reason the difference did not achieve any statistical significance was because of the small sample size and that the more technically challenging cases were all performed using the open approach. More importantly, the T-stage and number of lymph nodes harvested were comparable between the two groups, demonstrating that the oncological adequacy of the laparoscopic approach was as effective as that in the open technique.

Not surprisingly, all patients requiring multivisceral resections and the majority with recurrent cancer in our series underwent open APR. This is due to the significant technical challenges that may be encountered intra-operatively, although there are already isolated reports on the feasibility of performing laparoscopic resections in these situations [14-15]. Hence, it is highly probable that with advancing laparoscopic techniques such as robotically assisted laparoscopy and the increasing laparoscopic experience of colorectal surgeons, the minimally invasive approach even for such technically demanding cases is likely to become more prevalent.

The rate of CRM involvement in our series was 35.7%, which is comparable to the 28 – 49% quoted in the literature [16-19]. The high rate of CRM involvement in distal rectal cancer has been attributed to the reduction in the mesorectal tissue volume in the distal rectum [19] and operating in such a confined space. CRM involvement has been identified in numerous series as an independent factor predicting higher local recurrence rates and poorer survival, which is also seen in our series. A recent series has supported the role of extralevator APR in distal rectal cancer, which involved the excision of the entire external sphincter complex and an additional cuff of levator ani muscle [19]. This has brought about a significant decrease in the rate of CRM involvement (49.6 to 20.3%). This technique in reducing the CRM involvement and possibly improving the long term outcome in these patients merits further evaluation.

The notable difference between the rates of CRM involvement between the two techniques in our series could be due to

various factors. Firstly, the anticipated more technically challenging cases were all performed using the open technique. In addition, the use of laparoscopy may have improved the quality of resection by providing better views especially in patients with a deep pelvis. Although the difference in the rates of CRM positivity was not reported in the other series [3], the technical advantages seen in our series are likely a result of judicious patient selection in the laparoscopic group.

There are several limitations in our study. The relatively small number of patients made any conclusions in results comparing the two groups difficult. With the increasing surgical expertise, the improving results with neoadjuvant chemoradiation and improving staple techniques that are available, it is noteworthy that fewer sphincter sacrificing procedures are now being performed for patients with distal rectal cancers. The retrospective nature of data accrual from a single institution also presents with its inherent limitations. The selection bias of having the more technically challenging cases in the open APR group would naturally confer a certain survival advantage towards the laparoscopic group. The higher incidence of patients with recurrent disease, and those requiring mult i-visceral resection in the open APR group are also factors that would have impacted the long term outcomes. We have attempted to perform a subset analysis to address these to support our conclusions.

CONCLUSIONS

Laparoscopic APR is a safe and oncologically effective approach in treating patients with distal rectal cancer. Long term outcome is determined by the tumour stage and circumferential resection margin positivity and not significantly affected by the laparoscopic approach.

REFERENCES

1. Kuhry E, Schwenk W, Gaupset R, Romild U, Bonjer J. Long-term outcome of laparoscopic surgery for colorectal cancer: a cochrane systematic review of randomised controlled trials. Cancer Treat Rev. 2008 Oct; 34(6): 498-504
2. Bonjer HJ, Hop WC, Nelson H, Sargent DJ, Lacy AM, Castells A, *et al.* Laparoscopically assisted vs open colectomy for colon cancer: a meta-analysis. Arch Surg. 2007 Mar; 142(3): 298-303.
3. Guillou PJ, Quirke P, Thorpe H, *et al;* MRC CLASICC trial group. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): Multicentre randomised controlled trial. Lancet. 2005 May 14-20; 365(9472): 1718-26.
4. Wu JS, Birnbaum EH, Fleshman JW. Early experience with laparoscopic abdominoperineal resection. Surg Endosc. 1997 May; 11(5): 449-55.
5. Köckerling F, Scheidbach H, Schneider C, *et al.* Laparoscopic abdominoperineal resection: early postoperative results of a prospective study involving 116 patients. Dis Colon Rectum. 2000 Nov; 43(11): 1503-11.
6. Fleshman JW, Wexner SD, Anvari M, *et al.* Laparoscopic vs. open abdominoperineal resection for cancer. Dis Colon Rectum. 1999 Jul; 42(7): 930-9.
7. Feliciotti F, Guerrieri M, Paganini AM, *et al.* Long-term results of laparoscopic versus open resections for rectal cancer for 124 unselected patients. Surg Endosc. 2003 Oct; 17(10): 1530-5.
8. Roslani AC, Koh DC, Tsang CB, Wong KS, Cheong WK, Wong HB. Hand-assisted laparoscopic colectomy versus standard laparoscopic colectomy: a cost analysis. Colorectal Dis. 2009 Jun; 11(5): 496-501.
9. Shabbir A, Roslani AC, Wong KS, Tsang CB, Wong HB, Cheong WK. Is laparoscopic colectomy as cost beneficial as open colectomy? ANZ J Surg. 2009 Apr; 79(4): 265-70.
10. Figueredo A, Rumble RB, Maroun J, *et al.* Follow-up of patients with curatively resected colorectal cancer: a practice guideline. BMC Cancer. 2003 Oct 6; 3: 26.
11. Tjandra JJ, Chan MK. Follow-up after curative resection of colorectal cancer: a metaanalysis. Dis Colon Rectum. 2007 Nov; 50(11): 1783-99.
12. Koh DC, Law CW, Kristian I, Cheong WK, Tsang CB. Hand-assisted laparoscopic abdomino-perineal resection utilizing the planned end colostomy site. Tech Coloproctol. 2010 Jun; 14(2): 201-6
13. Seow-Choen F, Eu KW, Ho YH, Leong AF. A preliminary comparison of a consecutive series of open versus laparoscopic abdomino-perineal resection for rectal adenocarcinoma. Int J Colorectal Dis. 1997; 12(2): 88-90.
14. Williams GL, Gonsalves S, Bandyopadhyay D, Sagar PM. Laparoscopic abdominosacral composite resection for locally advanced primary rectal cancer. Tech Coloproctol. 2008 Dec; 12(4): 299-302
15. Kim SH, Neve RS, Joh YG. Relaparoscopy for salvage surgery in anastomotic recurrence of rectal cancer: feasible and safe. Dis Colon Rectum. 2008 Nov; 51(11): 1712-3.
16. den Dulk M, Marijnen CA, Putter H, *et al.* Risk factors for adverse outcome in patients with rectal cancer treated with an abdominoperineal resection in the total mesorectal excision trial. Ann Surg. 2007 Jul; 246(1): 83-90.
17. Marr R, Birbeck K, Garvican J, *et al.* The modern abdominoperineal excision: the next challenge after total mesorectal excision. Ann Surg. 2005; 242(1): 74-82.
18. Birbeck KF, Macklin CP, Tiffin NJ, *et al.* Rates of circumferential resection margin involvement vary between surgeons and predict outcomes in rectal cancer surgery. Ann Surg. 2002; 235(4): 449-57.
19. West NP, Anderin C, Smith KJ, Holm T, Quirke P; European Extralevator Abdominoperineal Excision Study Group. Multicentre experience with extralevator abdominoperineal excision for low rectal cancer. Br J Surg. 2010; 97(4): 588-99.